

Bibliography of Subsidence-Related Literature



by

B. A. Trent, R. A. Bauer, P. B. DuMontelle

Illinois State Geological Survey

Illinois Mine Subsidence Research Program

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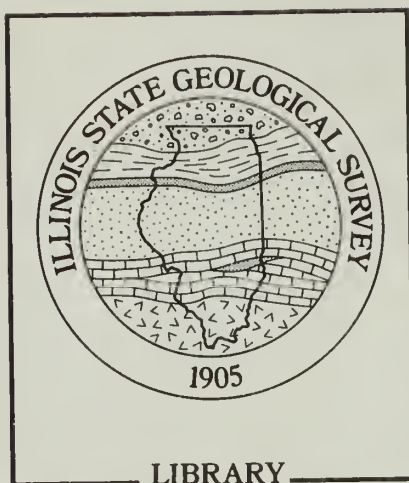
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BUREAU OF MINES

United States Department of the Interior



The **Illinois Mine Subsidence Research Program (IMSRP)** was established in 1985 to investigate methods and develop guidelines for underground mining operations that aim to maximize coal extraction yet preserve the productivity of prime farmland. The research program was initiated by the Illinois Coal Association and the Illinois Farm Bureau.

The Illinois State Geological Survey, a division of the Illinois Department of Energy and Natural Resources, is directing the IMSRP. Participating research institutions include Southern Illinois University at Carbondale, the University of Illinois at Urbana-Champaign, Northern Illinois University, and the Illinois State Geological Survey. A five-year Memorandum of Agreement, signed by the State of Illinois and the Bureau of Mines, U.S. Department of the Interior, ensures collaboration, cooperation, and financial support through 1991. Major funding is also provided by the Illinois Coal Development Board.

This publication is one in a series printed and distributed by the Illinois State Geological Survey as a service to the IMSRP. In the interest of making this information available to the public as quickly as possible, this bibliography has been reviewed for technical accuracy only.

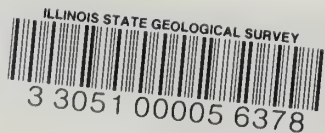
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Bibliography of Subsidence-Related Literature

B. A. Trent, R. A. Bauer, P. B. DuMontelle
Illinois State Geological Survey

The Illinois Mine Subsidence Research Program (IMSRP) compiled this bibliography as an aid to mining company technical personnel, persons involved with agriculture in coal-resource areas in Illinois, and mine subsidence researchers. The references were entered onto a computer database management system at the Illinois State Geological Survey (ISGS). Entries were collected from journals, proceedings, bibliographies, public and private libraries, and other sources.

The 2200 references in this bibliography represent the output of the database as of January 1, 1988. This bibliography is not intended to be complete--it will be continually updated. The references are listed alphabetically by first author and year of publication. Short abstracts or descriptions of the works are included with many of the entries. Key subjects are included for each entry. The subject-author index that accompanies the reference list includes 100 selected key subjects.

This database is designed for computer access using more than one keyword. The keywords selected to produce the subject-author index show the advantage of making on-line searches. For example, more than two pages of authors are listed under the keyword "coal mining." During an on-line search, a second, third, or fourth keyword would be entered to narrow the search and better fit the researcher's interest. We have printed the bibliography so that those without access to computers or the ISGS facilities can use the material, and also so that authors may check their entries for errors and omissions.

Readers are invited to call or write the Earth Hazards and Engineering Geology Section of the ISGS with requests for specific searches. The books and articles listed are not necessarily available in libraries; many items may be out of print. We will be pleased to assist researchers in locating reference material if the material is available. Researchers are invited to submit additions to the bibliography. We prefer to receive copies of articles so that we can more easily select key words.

The basis for this bibliography is INMAGIC, a database management system developed for library use by Inmagic, Inc., Cambridge, MA. The original 741 references used for this database came from U.S. Bureau of Mines Information Circular 9007, "Subsidence Information for Underground Mines--Literature Assessment and Annotated Bibliography." We have followed the general format of IC 9007 for this bibliography. The IMSRP Technical Committee helped to select entries and keywords.

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surface water, subsurface water, coal mining, multiple-seam extraction, longwall, monitoring design, modeling, instrumentation, prediction, subsidence research

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A cement company in Illinois successfully stopped a coal company from mining underneath its property. The cement company was mining limestone and shale about 125 ft. under the surface, by the room-and-pillar method. The coal company was mining by longwall advance methods in a seam about 450 ft. below the limestone bed. Survey data were collected for over three years and used as evidence in the suit.

longwall, law, non-metal mining, room-and-pillar, multiple-seam extraction, utilities, coal mining

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ground control, room-and-pillar

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roof support, roof stability

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subsurface water, monitoring design, monitoring installation, monitoring equipment, coal mining, longwall

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horizontal displacement, prediction, computer

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mine design, ground control, longwall, roof stability, roof support

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prediction, surface subsidence damage

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surface subsidence damage, coal mining

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overburden, subsurface subsidence damage, coal mining

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abandoned mines, coal mining, longwall, room-and-pillar, geologic features

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rock mechanics, coal mining, lab testing

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roof support, ground control, pillar strength

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law, government, economics, coal mining, longwall, insurance

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subsurface water, anthracite, coal mining

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mine design, mine operation, roof stability, economics, ground control

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mine design, survey methods, partial extraction, backfilling, survey methods, subsidence research

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surface structural damage, architecture, construction, foundations, economics

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overburden, coal mining, geologic features

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coal mining, abandoned mines, geophysical methods

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modeling, finite element method

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finite element method, modeling

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modeling, finite element method, prediction

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surface water, oil extraction, fluid extraction

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rock mechanics

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pillar strength, in situ testing, coal mining

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monitoring design, coal mining

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roof support, roof stability, rock mechanics, coal mining

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abandoned mines, room-and-pillar, geologic features, hydrology, surface structural damage, rock mechanics, instrumentation, coal mining

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room-and-pillar, coal mining, mine design, mine safety, ground control, roof stability, bumps, metal mining, rock mechanics, roof support, pillar strength, modeling, monitoring methods, abandoned mines, monitoring equipment, backfilling

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construction, surface structural damage

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subsurface water, surface water, hydrology, coal mining

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backfilling, mine fires

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hydrology, mine safety

Cleary, E. T. Robbing Mine Supports May Have Caused Shenandoah Subsidence. Eng. News Record, v. 124, 1940, pp. 358-380.

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coal mining, utilities, surface structural damage, pillar extraction

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metal mining, mine design, room-and-pillar

Clemens, J. M. Monterey No. 1, A Modern Coal Mine. Mining Follows the Quadrant Plan. Coal Mining and Processing, v. 9, No. 6, 1972, pp. 38-43.

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roof support, mine design, mine operation, pillar strength, room-and-pillar, coal mining, active mines

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surface structural damage, anthracite, coal mining

Coal Age. Hydraulic Stowage at Home and Abroad. v. 25, 1924.

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backfilling, coal mining

Coal Age. Coal Preparation Refuse Disposal. v. 67, July, 1962, p. 206.

Discusses methods of transporting coal preparation waste, including a brief mention of hydraulic transport for both surface and subsurface disposal.

mine operation, mine waste, backfilling, coal mining

Coal Age. Longwall Mining. McGraw-Hill, Inc., New York, 1965.

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longwall, mine design, mine operation, coal mining

Coal Mining and Processing. How to Calculate Factors in Mining Subsidence. v. 4, No. 5, 1967, pp. 28-33.

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mine design, backfilling, mine waste, time factor, coal mining

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vertical displacement, horizontal displacement, coal mining

Coal Mining and Processing. Illinois to Conduct Subsidence Study. v. 19, No. 10, 1982, p. 17.

coal mining, subsidence research

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Presents a pillar loading prediction method. Includes measurements of pillar stresses in iron mines and uranium mines.

prediction, pillar strength, metal mining

Coates, D. F. Pillar Loading. Research Report, Dept. of Mines and Technical Surveys, Ottawa, Canada, 1965-66.

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pillar strength, mine design, room-and-pillar, rock mechanics

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rock mechanics

Coates, D. F., Y. S. Yo. Rock Anchor Design Mechanics. Canadian Mining Research Center, Ottawa, Canada, Research Report 223, Jan. 1971, 13 pp.

roof bolting, ground control, rock mechanics

Coates, D. F., M. Gyenge. Incremental Design in Rock Mechanics. Min. Res. Centre, Mines Branch, Dep. Energy, Mines and Resour., Canada, Mines Branch Monograph 880, 1973, pp. 5-1 to 5-15.

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vertical displacement, horizontal displacement, rock mechanics, prediction, mathematical modeling

Coates, D. F. Rock Mechanics Principles. Canadian Dept. of Energy, Mines and Resources, Mine Branch Monograph 874, 1970, rev. 1974.

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rock mechanics, pillar strength, ground control, mine design

Coates, D. F. Rock Mechanics Principles. Chapter 5 in Stopes, Caving and Subsidence. Min. Res. Centre, Mines Branch, Dep. Energy Mines and Resour., Minister of Supply and Services, Ottawa, Canada, 1978, pp. 5-1 to 5-38.

rock mechanics

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The Bureau of Mines investigated subsidence caused by recent underground mining, estimated the extent of damages, and formulated a procedure for evaluating subsidence costs.

mitigation, economics, surface subsidence control, active mines

Coe, C. J., S. M. Stowe. Evaluating the Impact of Longwall Coal Mining on the Hydrologic Balance. Proc., Symp. on Surface Mining, Hydrology, Sedimentology, and Reclamation, Univ. of Kentucky, Lexington, KY, Dec. 2-7, 1984, pp. 395-403.

subsurface water, hydrology, longwall, coal mining

Colaizzi, G. J., R. H. Whaite, D. L. Donner. Pumped-Slurry Backfilling of Abandoned Coal Mine Workings for Subsidence Control at Rock Springs, Wyo. U.S. Bureau of Mines IC 8846, 1981, 100 pp.

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backfilling, economics, ground control, abandoned mines, coal mining

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backfilling, anthracite, coal mining, roof support, pillar extraction

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backfilling

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mine design, finite element method, modeling, longwall, roof support

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metal mining, engineering

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modeling, prediction, computer, longwall, influence function, finite element method, backfilling

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room-and-pillar, mine design, rock mechanics

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rock mechanics, roof stability, coal mining

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 Discusses the strength of coal based on the specimen size and the least dimension of the specimen. Based on experimental data, a series of conclusions regarding coal strength are presented.
 rock mechanics, pillar strength, coal mining, lab testing
- Holland, C. T. Final Report on the Effect of Mining Upon and Methods of Protecting Earthfill Dams Located in the Wheeling Creek Area. Report to the U.S. Dept. of Agriculture, Soil Conservation Service, Morgantown, WV, March 20, 1965.
 Describes required support in the form of unmined coal beneath proposed earth dams in Pennsylvania and West Virginia. To justify recommendations presented, the current (1965) state of knowledge concerning subsidence parameters and coal strength for the area and seams in question is summarized.
 pillar strength, surface structural damage, coal mining
- Holland, C. T., D. A. Olsen. Interfacial Friction, Moisture, and Coal Pillar Strength. Trans., AIME, v. 241, 1968, pp. 323-328.
 Discusses the development of a formula for estimation of coal pillar strength. One of the factors involved in this formula is the coefficient of friction between the coal pillar and the adjacent rock with which it is in contact.
 coal mining, pillar strength, in situ testing
- Holland, C. T. Thirty Years' Experience in Applying Rock Mechanics to Roof Control in Coal Mining. AIME Preprint 71-F-347, 1971.
 Reviews the historical and current methods of roof control, including pillar/room dimension, rock bolting, geological considerations, and depth of overburden.
 roof stability, roof support, ground control, room-and-pillar, overburden, coal mining
- Holland, C. T. Mine Pillar Design. SME Mining Engineering Handbook, ed. by A. B. Cummins and I. A. Givens, AIME, New York, 1973, pp. 13-96 to 13-118.
 pillar strength, ground control, mine design
- Holland, C. T. Pillar Design for Permanent and Semi-Permanent Support of the Overburden in Coal Mines. Proc., 9th Canadian Rock Mechanics Symposium, Montreal, 1973.
 rock mechanics, mine design, pillar strength, yielding supports, overburden
- Hollingshead, G. W. Stress Distribution in Rock Anchors. Can. Geotech. J., v. 8, 1971, pp. 588-592.
 roof bolting, ground control
- Holm, J. D. Mine Subsidence Insurance for Colorado: A Risk Management Approach. Proc., 1985 Conf. on Coal Mine Subsidence in the Rocky Mountain Region, Colorado Springs, CO, Oct. 28-30, 1985, J. L. Hynes, ed., pp. 281-298. Colorado Geological Survey Special Publication 31, Department of Natural Resources, Denver, CO, 1986.

The State of Colorado is in the final stages of developing a Subsidence Insurance Program which will be operated by one or more private insurance companies. The state's involvement is necessitated by provisions in the federal legislation enabling the program. Also, no specific subsidence risk insurance is available in the market place today.

insurance, law, abandoned mines, reclamation, backfilling, mitigation, coal mining

Holzer, T. L. Ground Failure in Areas of Subsidence Due to Groundwater Decline in the United States. Proc., 2nd International Symposium on Land Subsidence, Anaheim, CA, IAHS-AISH Pub. No. 121, Dec., 1976, pp. 423-433.

hydrology, subsurface water, fluid extraction

Holzer, T. L., W. Thatcher. Modeling Deformation Due to Subsidence Faulting. International Conference on Evaluation and Prediction of Subsidence, Pensacola Beach, FL, 1978, ASCE.

modeling, geologic features

Holzer, T. L. Preconsolidation Stress of Aquifer Systems in Areas of Induced Land Subsidence. Water Resour. Res., Washington, DC, 1981, pp. 693-704.

hydrology, subsurface water, subsurface subsidence damage, overburden

Holzer, T. L. Land Subsidence: Its Impacts and Costs in the U.S. Underground Space, v. 9, No. 5-6, 1985, pp. 260-263.

Discusses land subsidence of all types which was either directly or indirectly caused by human activity. Activities causing land subsidence include subsurface mining, withdrawal of groundwater and petroleum from unconsolidated sediment, drainage of peat and muck soils, groundwater withdrawal from limestone, solution mining, and surface application of water to undercompacted sediment. Human-induced subsidence occurs in at least 38 states in the U.S.

economics, abandoned mines, surface structural damage, surface water, subsurface water, vertical displacement, oil extraction, metal mining, non-metal mining, coal mining, fluid extraction

Hood, M., R. T. Ewy, L. R. Riddle, J. J. K. Daemen. Empirical Methods for Subsidence Prediction and Their Applicability to U.S. Mining Conditions. Final Report, Contract No. 62-0200, Dept. of Material Science and Mining Engineering, Univ. of Calif., Berkeley, CA, Oct., 1981, 241 pp.

prediction

Hood, M., R. T. Ewy, L. R. Riddle. Empirical Methods of Subsidence Prediction--A Case Study. Chapter 8 in Workshop on Surface Subsidence Due to Underground Mining, S. S. Peng and M. Harthill, eds., Morgantown, WV, Nov. 30-Dec. 2, 1981. WV Univ., Morgantown, WV, Mar., 1982, pp. 100-122.

Compares subsidence profiles above two adjacent longwall retreat panels in Illinois with profiles predicting subsidence behavior obtained using (1) National Coal Board method, (2) the profile function method, and (3) the influence function method.

vertical displacement, horizontal displacement, prediction, longwall, National Coal Board, profile function, influence function

Hooker, V. E., D. L. Bickel, J. R. Aggson. In Situ Determination of Stresses in Mountainous Terrain. U.S. Bureau of Mines RI 7654, 1972, 19 pp.

in situ testing

Hooker, V. E. A Method of Evaluating Room and Pillar or Panel Design. Proc., U.S. Bureau of Mines Technology Transfer Seminar on Ground Control Aspects of Coal Mine Design, Lexington, KY, March, 1973; also U.S. Bureau of Mines IC 8630, 1974, pp. 44-48.

room-and-pillar, ground control, mine design

Hooker, V. E., D. L. Bickel. Overcoring Equipment and Techniques Used in Rock Stress Determination. U.S. Bureau of Mines IC 8618, 1974, 32 pp.

rock mechanics, overburden, in situ testing

Horn, H. M., T. W. Lambe. Settlement of Buildings on the MIT Campus. Journ. of Soil Mech. and Found. Engr. Div., ASCE, v. 90, SM5, 1964, pp. 181-196.

surface structural damage, soil mechanics, foundations

Hoskins, W. N., F. D. Wright, R. L. Tobie, J. B. Bills, R. P. Upadhyay, C. B. Sandberg. A Technical and Economic Study of Candidate Underground Mining Systems for Deep, Thick Oil Shale Deposits. Phase I Report, Contract S0241074, Cameron Eng., Inc. U.S. Bureau of Mines OFR 23-76, 1975, 331 pp. NTIS PB 249 884.

economics, mine design, oil extraction

Hoskins, W. N., R. P. Upadhyay, J. B. Bills, C. R. Sandberg, F. D. Wright, R. L. Tobie. A Technical and Economic Study of Candidate Underground Mining Systems for Deep, Thick Oil Shale Deposits. Final Report, Phase II, Contract S0241074, Cameron Eng., Inc. U.S. Bureau of Mines OFR 9-77, 1976, 318 pp. NTIS PB 262 525.

economics, mine design, oil extraction

House Committee on Interior and Insular Affairs. Surface Mining Control and Reclamation Act of 1977. House Report 95-218, Washington, D.C., 1977.
reclamation, law

Houser, F. N. Sequence of Surface Movement and Fracturing During Sink Subsidence, Nevada Test Site. U.S. Geological Survey, Report USGS-474-56, 1970.
surface subsidence damage

Howell, M., C. W. Amos. Improved Geophysical Techniques for Survey of Disturbed Ground. Chapter 5 in Site Investigations in Areas of Mining Subsidence, F. G. Bell, ed. Newnes-Butterworths, 1975, pp. 103-108.
survey methods, geophysical methods

Howell, R. C., F. D. Wright, I. A. Dearinger. Ground Movement and Pressure Changes Associated With Shortwall Mining. Pres. at 17th U.S. Symposium on Rock Mechanics, Snowbird, UT, Aug. 25-27, 1976. Preprint 4A3, Univ. UT, UT Eng. Exp. Station, 1976, 6 pp.
rock mechanics, shortwall, ground control, instrumentation, monitoring methods

Howes, M. R., M. A. Culp, H. Greenberg, P. E. VanDorpe. Underground Coal Mines of Centerville, Iowa, and Vicinity. Iowa Dept. of Natural Resources Open File Report 86-2, 1986, 93 pp. Iowa Geological Survey Bureau, Iowa City, IA.

Extensive underground mining occurred in the Centerville area, Appanoose County, Iowa Between 1850 and 1971. Coal production was exclusively from the Mystic Coal Member of the Labette Shale (Pennsylvanian). The location and extent of abandoned coal mines and known occurrences of mine-related problems in the area is documented. A map shows the location and extent of coal mines and a compilation of mine-related information including historical and physical data.

coal mining, abandoned mines, historical, land-use planning, longwall, room-and-pillar

HRastnik, J. Problems of Determining the Safe Thickness of Impermeable Clay Layer Between Coal Seam and Water-Bearing Sand Layers In the Hanging Wall. Rud.- Metal. ZB., No. 1, 1971, pp. 47-59.
coal mining, subsurface water, geologic features, mine operation

HRB-Singer, Inc. Proposed Techniques for Evaluating Subsidence Risk and Planning and Engineering Alternatives for Use by Housing and Urban Development (HUD) and Local Governments (Task E). HUD contract H-2385, 1977, 120 pp. NTIS PB 81-100992.

Discusses evaluation of subsidence risk/planning and engineering alternatives for adjusting to hazards resulting from subsidence related to underground mining, occurring in organic wetlands, and in karst terrains.

vertical displacement, horizontal displacement, law, mine design, backfilling, land-use planning, environment, geologic features

HRB-Singer, Inc. Community Land Subsidence. Final Report for U.S. Dept. of Housing and Urban Development, Washington, D.C., under contract H-2385, 1977.
land-use planning, government, environment

HRB-Singer, Inc. The Nature and Distribution of Subsidence Problems Affecting HUD and Urban Areas. Task A, HUD Contract H-2385, 1977, 113 pp. NTIS PB 80-17277-8.
government, land-use planning, surface subsidence damage

Hubbard, J. S. Longwall Experience at the Gateway Mine. Mining Congress Journal, v. 57, No. 10, 1971, pp. 43-47.

Describes a longwall system designed specifically for a seam. Increased mine safety is noted because of this special design, and because self-advancing hydraulic roof supports were used.

coal mining, longwall, mine design, roof support

Hubert, E. Dust Hazards Caused by Pneumatic Stowing. Colliery Guardian, v. 200, No. 5167, April, 1960, p. 457.
backfilling, mine safety

Hucka, V., B. Das. Coal Mining: Better Seam-Mining By Evaluating Joints, Cleats, Petrological Profile. Western Miner, v. 48, No. 3, 1975, pp. 35-40.
roof stability, ground control, geologic features

Hucka, V. J., C. K. Blair, E. P. Kimball. Mine Subsidence Effects on a Pressurized Natural Gas Pipeline. Preprint No. 83-386, for presentation at the SME-AIME Fall Meeting and Exhibit, Salt Lake City Utah, Oct. 19-21, 1983, 10 pp.

A 20 inch diameter high-pressure natural gas pipeline crosses over a coal mine in central Utah. The room-and-pillar method with pillar extraction is being used to extract the coal from the seams. The pillars beneath the pipeline will not be extracted. An attempt has been made to predict subsidence in the area where pillars may collapse; a network of survey points has been installed along the pipeline to detect ground movements.

utilities, pipelines, survey methods, survey design, multiple-seam extraction, pillar strength, coal mining, pillar extraction

HUD Challenge. Backfilling Abandoned Mines. v. 4, No. 9, Sept. 1973, p. 30.

Describes the use of the Dowell process at Rock Springs, WY.
backfilling, abandoned mines

Hudspeth, H. M. Ground Movement in Advance of Longwalls. Iron and Coal Trades Review, v. 126, 1933, pp. 1-3.

Roadways were driven in the coal in advance of the working faces of two mines. Telescoping measuring rods were used to record raise in floor and convergence of roof.

longwall, monitoring equipment, coal mining, floor stability, roof stability

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Describes general and mathematical considerations of fractures forming in coal measure strata. Results are given of experiments with models.

overburden, modeling, coal mining

Hudspeth, H. M., D. W. Phillips, A. Walker. North of England Institute of Mining and Mechanical Engineers' Support of Workings in Mines Committee--Fourth Progress Report. Trans., Inst. of Mining Engineers, v. 91, 1935-36, pp. 349-367.

Discusses the effects of depth, width of working, strength of roof, sides, and/or floor on roof falls.

roof stability, room-and-pillar, floor stability

Hunt, S. R. Characterization of Subsidence Profiles Over Room-and-Pillar Coal Mines In Illinois. Pres. at Soc. Min. Eng. AIME Annu. Meeting, New Orleans, LA, Feb. 18-22, 1979. Soc. Min. Eng. AIME Preprint 79-126, 15 pp.

room-and-pillar, coal mining

Hunt, S. R. Surface Subsidence Due to Coal Mining in Illinois. Ph.D. Dissertation, Univ. IL, Urbana, IL, 1980, 129 pp.

surface subsidence damage, coal mining

Hunter, D. W. Bridgeway Mining: A New Concept. Coal Age, Sept., 1972.

Discusses utilization of longwall mining in West Virginia.

coal mining, mine design, longwall

Hunter, J. Pneumatic Stowing at Bullcroft Main Colliery. Trans., Institution of Mining Engineers, v. 105, 1945-46, p. 111.

Reviews packing of mined out areas in subject mine prior to utilization of pneumatic backfilling; also details backfilling devices and methods.

backfilling

Hunter, R. Longwall Mining. Presented at the 1st NCA/BCR Proc. Symp. Min. Methods, Harrogate, Oct. 30-Nov. 1, 1974, pp. 57-64.

mine design, ground control, longwall, roof stability, roof support, coal mining

Hurst, G. Avoiding Subsidence Effects in Surface Buildings. Colliery Eng., v. 25, No. 291, May 1948, pp. 158-163; v. 25, No. 292, June 1948, pp. 194-198; v. 25, No. 293, July 1948, pp. 230-234.

Guidelines are given for designing buildings to avoid the detrimental effects of subsidence. surface structural damage, foundations, engineering, construction, architecture

Hurst, G. Protection of the Surface in Mining Areas. Colliery Eng., v. 25, No. 287, Jan. 1948, pp. 14-22; v. 25, No. 288, Feb. 1948, pp. 43-46.

surface subsidence damage, ground control

Hurst, G. The Lorraine Coalfield. Colliery Eng., v. 35, Sept. 1958, pp. 374-381; v. 35, Oct. 1958, pp. 445-450.

Discusses the working of a near-vertical coal seam in a French coalfield which maintained one of the highest production rates in Europe at the time. The system employed stope caving with hydraulic sand filling.

backfilling, coal mining

Hurst, G., F. Owen, C. Bayrac. Some Observations On the Behavior of a Large School Subject to Mining Subsidence. Colliery Eng., v. 43, July, 1966, pp. 295-301, and Aug. 1966, pp. 343-350.

Describes a study of subsidence damage to a school underlain by limestone, which in turn was underlain by mine workings of two seams. The foundation of the school was constructed specially to guard against subsidence effects, but it was still damaged extensively.

surface structural damage, multiple-seam extraction, foundations, architecture

Hurst, R. E., L. D. Boughton. Subsidence Control--Backfilling of Waterfilled Mines. Proc., Environmental Quality Conference, Washington, DC, June 7-9, 1971. Soc. Min. Eng AIME, Littleton, CO, 1971, pp. 129-136.
backfilling

Hurst, R. E. Statement Before the U.S. Senate Interior Committee on Minerals, Materials, and Fuels. Dec. 2, 1971.
Compares controlled and blind backfilling with the Dowell process.
backfilling

Hustrulid, W. A. A Review of Coal Pillar Strength Formulas. Rock Mech., v. 8, 1976, pp. 115-145.
pillar strength, ground control, rock mechanics, coal mining

Hutchings, R., M. Fajdiga, D. Raisbeck. The Effects of Large Ground Movements Resulting from Brown Coal Open-Cut Excavations in the Latrobe Valley, Victoria. Proc., Conf. on Large Ground Movements and Structures, Cardiff, Wales, July 4-7, 1977. Large Ground Movements and Structures, J. D. Geddes, ed., 1978, pp. 136-161.
ground control, subsurface subsidence damage, surface subsidence damage, coal mining

Huwood-Irwin Co. 1977 Census of Longwall Installations Operating in the United States. Off the Wall: Longwall Newsletter, v. 1, No. 3, P.O. Box 409, Irwin, PA 15642, 1978.
longwall

Hvorslev, M. J. Physical Components of the Shear Strength of Saturated Clays. ASCE Research Conference on Shear Strength of Cohesive Soils, Boulder, CO, 1960, pp. 169-273.
floor stability, rock mechanics, lab testing

Hylbert, D. K. Developing Geological Structural Criteria for Predicting Unstable Mine Roof Rocks. Appalachian Coal Min. Inst., Moorhead State Univ., Contract H0133018, U.S. Bureau of Mines OFR 9-78, 1977, 249 pp. NTIS P8 276-735/AS.
roof stability, coal mining, geologic features

Hylbert, P. K. The Classification, Evaluation, and Projection of Coal Mine Roofs in Advance of Mining. Mining Engineering, Dec., 1978, v. 30, pp. 1667-1676.
roof stability, coal mining

Hynes, J. L. Essential Components of a Mine Subsidence Investigation. Proc., 1985 Conf. on Coal Mine Subsidence in the Rocky Mountain Region, Colorado Springs, CO, Oct. 28-30, 1985, J. L. Hynes, ed., pp. 81-86. Colorado Geological Survey Special Publication 31, Department of Natural Resources, Denver, CO, 1986.

Many factors affect the reliability, accuracy, and usefulness of the results of a subsidence investigation above abandoned mines. Within control of the investigator are several organizational and data acquisition requirements which are critical to the success of the study, including mapping, drilling, down-hole geophysics, sampling and testing, a site survey, and site evaluation.

abandoned mines, monitoring methods, survey methods, geophysical methods, surface structural damage, modeling, prediction, lab testing

Hynes, J. L., ed. Proceedings of the 1985 Conference on Coal Mine Subsidence in the Rocky Mountain Region. Colorado Springs, CO, Oct. 28-30, 1985. Colorado Geological Survey Special Publication 31, Department of Natural Resources, Denver, CO, 1986.

Impacts of subsidence are especially significant in the Rocky Mountain West where population growth and rapid community expansion have increased development pressure on significant areas of subsidence-prone ground. The present consequences of unrecognized and poorly managed subsidence hazards are much more serious in the emerging urban and suburban environment than they were in the past where they occurred primarily in agricultural lands.

reclamation, abandoned mines, historical, mine fires, surface structural damage, remote sensing, photography, backfilling, modeling, prediction, room-and-pillar, monitoring design, mitigation, architecture, surface subsidence control, land-use planning, insurance, coal mining

Iannacchione, A. T., J. T. Popp, J. A. Rulli. The Occurrence and Characterization of Geologic Anomalies and Cutter Roof Failure: Their Effect on Gateroad Stability. Paper in Stability in Underground Mining II, SME-AIME, 1984, pp. 428-445.
roof stability, mine design, geologic features

IASH-AIHS. Land Subsidence--Affaissement du Sol. Proc., 1969 Tokyo Conference, IASH-Unesco Publication No. 88 and No. 89, 1969.

IASH-AIHS. Land Subsidence Symposium. Proc., 2nd International Symposium on Land Subsidence, Anaheim, CA, Dec., 1976, IASH-AIHS Publication no. 1, 121 pp.

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law, government, reclamation, environment, coal mining

Illinois Department of Mines and Minerals. The Surface Coal Mining Land Conservation and Reclamation Act, June 1, 1980. Land Reclamation Division, 1983, 40 pp.

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law, mine operation, coal mining

Illinois State Geological Survey. Subsidence at Hegeler, Illinois. Int. Field Rep, 1967, 9 pp.

coal mining, surface structural damage, utilities

Illinois State Geological Survey. Review of Underground Mining Practices in Illinois as Related to Aspects of Mine Subsidence With Recommendations For Legislation. Inst. of Nat. Resour. Document 80/10, 1980, 142 pp.

law, government, mine design

Imim, H. I. Memorandum of Evidence to the Committee on Mining Subsidence. Submitted by the Council of the IME, Trans. of the Institution of Mining Engineers, London, v. 107, 1947, pp. 50-64.

Observations and recommendations were made pertaining to subsidence legislation, legal settlements, and building construction, with respect to coal mining.

law, construction, coal mining

Imim, H. I. A Viscoelastic Analysis of Mine Subsidence in Horizontal Laminated Strata. Ph.D. dissertation, Univ. MN, Minneapolis, MN, 1965, 63 pp.

ground control, continuum mechanics theories, modeling

Institute of Civil Engineering (London) Ground Subsidence. Thomas Telford Ltd., 1977, 99 pp.

This reference consists of a guidance to good practice for the civil engineer who is not a specialist in the area of ground subsidence; it is divided into seven sections dealing with the causes and effects of both natural and induced surface subsidence.

vertical displacement, horizontal displacement, surface structural damage, subsurface structural damage, surface water, mine design, backfilling, surface subsidence control, engineering

The Institution of Civil Engineers. Report on Mining Subsidence. London, England, 1959, 52 pp.; reprint, 1962, 51 pp.

surface structural damage, backfilling, engineering, pillar strength

Institution of Mining Engineers. A Simple Method of Water Stowage Employed at No. 5 Pit at the Escarpelle Mines. Trans., Inst. of Mining Engineers, v. 35, 1907-1908, p. 79.

backfilling, historical

Institution of Mining Engineers. Pneumatic Stowing at Bullcroft Main Colliery. v. 105, 1945, p. 315.

backfilling

Institution of Mining Engineers. Effects of Stowing on Surface Subsidence. Trans., v. 107, No. 58, 1947.

backfilling

Institution of Municipal Engineers. Report of Special Committee on Mining Subsidence. London, 1947, 80 pp.

Institution of Structural Engineers. Structure-Soil Interaction--A State of the Art Report. 11 Upper Belgrave St., London, 1978.

surface structural damage, foundations, soils

Inter-Agency Committee on Land Subsidence in the San Joaquin Valley. Progress Report on Land-Subsidence Investigations in the San Joaquin Valley, California Through 1957. Inter-Agency Comm. Land Subsidence in the San Joaquin Valley, Sacramento, CA, 1958, 160 pp.

fluid extraction

International Association of Science and Hydrology--UNESCO. Land Subsidence (Louvain, Belgium). AIHS, Cesterick, S.A., v. 1-2, Publ. 88-89, 1970, 661 pp.

hydrology

Iron and Coal Trades Review. High Speed Throwing Belt for Mechanical Stowing. v. 136, 1938, p. 488.

backfilling

Iron and Coal Trades Review. Pneumatic Stowing at Lockhead Colliery. v. 138, 1938, pp. 276-277.

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mine design, ground control, longwall, shortwall, roof stability, roof support, coal mining
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roof stability, roof support, longwall
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roof support, ground control
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roof stability, roof support
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surface subsidence damage
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longwall, pillar strength, mine design, coal mining
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finite element method, coal mining, modeling
- Ishijima, Y., T. Isobe. The Simulation to Analyze Surface Subsidence Using Three Dimensional Finite Element Method. Paper in *Subsidence in Mines*, ed. by A. J. Hargraves, *Proc. 4th Annu. Symp. on Subsidence in Mines*, Wollongong, Australia, Feb. 20-22, 1973. *Australasian Inst. Min. Metall.*, Illawarra Branch, Paper 11, 1973, pp. 11-1--11-5.
finite element method, modeling
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rock mechanics, ground control, in situ testing
- Ivey, J. B. Guidelines For Engineering Geologic Investigations in Areas of Coal Mine Subsidence: A Response To Land-Use Planning Needs. *Bull. Assoc. Eng. Geol.*, v. 15, No. 2, 1978, pp. 163-174.
engineering, land-use planning, coal mining
- Ivey, J. B. Coal Mine Subsidence, Past, Present, and Future, in the Rocky Mountains. *Proc., 1985 Conf. on Coal Mine Subsidence in the Rocky Mountain Region*, Colorado Springs, CO, Oct. 28-30, 1985, J. L. Hynes, ed., pp. 1-14. *Colorado Geological Survey Special Publication 31*, Department of Natural Resources, Denver, CO, 1986.
historical, land-use planning, law, surface structural damage, coal mining
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Describes the effects of subsidence on structures at ground surface, as a result of shallow coal mining operations.
survey methods, geotechnical, photography, instrumentation, surface structural damage, longwall, monitoring equipment, coal mining
- Jack, B. W. Case Studies of the Effects of Surface Subsidence on Gravel and Provincial Bituminous Roads. *SANGORM Symposium*, Oct. 21, 1986, Sandton, South Africa, pp. 97-114. *International Society for Rock Mechanics*, South African National Group.
Total extraction of coal seams can cause damage to the surface and structures undermined. Roads of various types are the predominant structures which traverse the coalfields of South Africa. Instrumentation and monitoring techniques for case studies are described and the findings given.
coal mining, monitoring methods, survey methods, instrumentation, roads
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backfilling, mine waste

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monitoring equipment, modeling, metal mining

Jacobsen, W. E., J. S. Bhutani, J. C. Elliott. Subsidence Monitoring in Conjunction with Underground Mine Flushing Operations. Contract S0144073, Mitre Corp. U.S. Bureau of Mines OFR 34-76, 1975, 154 pp. NTIS PB 250 818.
monitoring design, backfilling, monitoring methods

Jacobsen, W. E., J. P. Morris. Surface Subsidence from Mining--Reduction of Trigonometric Leveling Data. Mitre Corp., Rep. MTR-6899, June 1975, 24 pp.
survey data processing

Jacquin, C., M. T. Poulet. Study of the Hydrodynamic Pattern in a Sedimentary Basin Subject to Subsidence. Society of Petroleum Engineers Paper 2988, 45th Annual Fall Meeting SPE (AIME), Houston, TX, 1970.
hydrology, oil extraction

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mine operation, roof stability, coal mining

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instrumentation, monitoring equipment

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coal mining, active mines, longwall, mine operation, roof support, mine safety

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agriculture, reclamation, law

Jansen, R. B. Earth Movement at Baldwin Hills Reservoir. ASCE J. Soil Mech. Foundation Div., v. 93, No. SM4, Paper 5330, July 1967, pp. 551-575.
surface water

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coal mining, vertical displacement, horizontal displacement, mine design, geologic features, surface structural damage, time factor, prediction, influence function, active mines

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floor stability, coal mining

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mine design, ground control, longwall, roof stability

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longwall, survey data processing, coal mining

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backfilling, coal mining
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surface structural damage, mine design, coal mining, surface water

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surface structural damage, coal mining, pillar extraction, surface water, mine design, finite element method, mathematical modeling, land-use planning

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surface subsidence damage, subsurface subsidence damage, tunnelling

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computer, prediction, modeling

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zone area method, coal mining, modeling

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vertical displacement, zone area method, computer, prediction, longwall, room-and-pillar, modeling

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historical, law, environment, vertical displacement, horizontal displacement, coal mining

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surface structural damage, coal mining

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roof support, ground control

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law, mine operation, reclamation, environment

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geologic features, mine design, mine safety, coal mining, overburden

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coal mining, modeling, room-and-pillar, mine design, abandoned mines, time factor, overburden

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modeling, coal mining, room-and-pillar, overburden

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mine operation, mine fires, lab testing, coal mining

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monitoring equipment, monitoring installation, monitoring methods

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modeling, longwall, geologic features, lab testing

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surface subsidence damage, National Coal Board, law, coal mining

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coal mining, survey data processing

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mine design, mine operation, ground control

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surface structural damage, surface subsidence control, monitoring methods

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backfilling, active mines

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coal mining, instrumentation, vertical displacement, horizontal displacement, monitoring design, monitoring installation, monitoring equipment, survey methods, survey equipment, survey data processing, rock mechanics, longwall
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mine operation, overburden, geologic features
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computer, prediction, modeling
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surface structural damage, foundations, architecture
- Klepikov, S. N., A. V. Mashkin. Soil Mechanics Problems in Undermined Areas. Scientific-Research Institute of Constructional Elements (NIISK) of the Government Committee for Construction (Gosstroj) of the USSR. Translated from Osnovaniya, Fundamenty i Mekhanika Gruntov, No. 1, Jan.-Feb., 1984, pp. 3-5.
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abandoned mines, surface subsidence damage, horizontal displacement, historical, soils, roof stability, floor stability, pillar strength, coal mining

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surface water, surface subsidence damage, modeling

Mozumdar, B. K. A Mathematical Model of Ground Movement Due to Underground Mining. Ph.D. Thesis, PA State Univ., State College, PA, 1974, 130 pp.

mathematical modeling

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prediction, computer

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Subsidence profiles over Saskatchewan potash mines exhibit forms which cannot be explained by existing subsidence models. The subsidence is affected by bridging of competent rocks.

non-metal mining, modeling, profile function, influence function, prediction, rock mechanics, geologic features, overburden

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finite element method, overburden

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backfilling

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architecture, construction, surface structural damage

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Presents an analytic theory of subsidence that acts as a framework describing both the time-dependent and time-independent aspects of the subsidence process. Also included is a description of the numerical tests performed on this proposed model using a finite element computer program.

vertical displacement, horizontal displacement, computer, rock mechanics, time factor, finite element method, modeling

Munson, D. E., W. F. Eichfeld. Evaluation of European Empirical Methods for Subsidence in U.S. Coal Fields. U.S. Dep. Energy contract SAND 80-0537, Sandia Natl. Lab., 1980, 27 pp. NTIS SAND-79-2355 C.

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vertical displacement, horizontal displacement, prediction theories, longwall, profile function, influence function, coal mining

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prediction theories, coal mining

Munson, D. E., H. J. Sutherland. Empirical and Analytic Approaches to Subsidence Prediction. Ch. 19 in Ground Control in Room-and-Pillar Mining, Y. P. Chugh, ed., SME-AIME, New York, 1982, pp. 139-149.

Empirical methods for describing the shape of the subsidence trough over coal mines in Europe are tested against field measurements of subsidence over longwall panels in the United States. The graphical methods developed by the National Coal Board in the U.K. do not correlate well with the U.S. measurements; however, the profile functions typically used on the Continent give acceptable fits to the data.

prediction, modeling, ground control, room-and-pillar, profile function, coal mining, National Coal Board

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backfilling, abandoned mines, active mines

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Subsidence insurance claims data and structural monitoring are presented. Also, the changes that have occurred in the Illinois Insurance Code during the first six years the IMSIF has been in existence are described.

surface structural damage, insurance, coal mining, historical, abandoned mines, monitoring methods, monitoring equipment

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elastic theory, mathematical modeling

Myers, A. R., J. B. Hansen, R. A. Lindvall, J. B. Ivey, J. L. Hynes. Coal Mine Subsidence and Land Use in the Boulder-Weld Coalfield, Colorado. Grant G0244001, CO Geol. Surv., U.S. Bureau of Mines OFR 64-77, 1975, 92 pp.

land-use planning, coal mining, abandoned mines

Myers, K. L., C. C. Rehn. Multi-Phased Subsidence Study and Use of Progressive Failure Model for Subsidence Prediction Above Room and Pillar Mines. Proc., 1985 Conf. on Coal Mine Subsidence in the Rocky Mountain Region, Colorado Springs, CO, Oct. 28-30, 1985, J. L. Hynes, ed., pp. 143-167.

Describes a study performed for a site in Colorado Springs located above abandoned room-and-pillar coal mines last worked in the 1920s and the 1940s. The three phases of the study involved a review of published data on the mines, a limited subsurface investigation, and a very detailed evaluation of the eastern portion of the site resulting in a prediction of final subsidence profile and ground strains.

abandoned mines, room-and-pillar, prediction, modeling, pillar strength, roof stability, floor stability, overburden, subsurface water, land-use planning, mitigation, backfilling, utilities, literature search, coal mining

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roof stability, floor stability, in situ testing

Narasimham, T. N., P. A. Witherspoon. Numerical Model for Land Subsidence in Shallow Groundwater Systems. Proc., 2nd International Symposium on Land Subsidence, Anaheim, CA, IAHS-AISH Pub. No. 121, Dec., 1976, pp. 133-143.

modeling, subsurface water

National Building Studies. Mining Subsidence Effects on Small Houses. Special Report No. 12, London, HMSO, 1951, pp. 24.

surface structural damage, construction

National Building Studies. Simplified Tables of External Loads on Buried Pipelines. Ministry of Works, No. 32, HMSO, London, 1962.

utilities, pipelines, subsurface structural damage

National Coal Board. Investigation of Mining Subsidence Phenomena. Inf. Bull. 52/78, 1952, 25 pp.

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National Coal Board. Partial Extraction as a Means of Reducing Subsidence Damage. Inf. Bull. 61/231, 1961, 16 pp.

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partial extraction, ground control, National Coal Board, coal mining, active mines

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horizontal displacement, ground control, backfilling, descriptive theories, coal mining, National Coal Board

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mine design, longwall, ground control, prediction, monitoring methods, geologic features, coal mining, National Coal Board

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National Coal Board, abandoned mines, reclamation, coal mining

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ground control, mine design, coal mining, National Coal Board
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prediction, surface structural damage, horizontal displacement, mitigation, engineering, vertical displacement, subsurface structural damage, surface water, surface subsidence control, descriptive theories, ground control, angle of draw, longwall, time factor, National Coal Board, coal mining
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mine waste, backfilling, coal mining
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coal mining, surface subsidence damage

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floor stability, coal mining

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surface subsidence damage, overburden, surface structural damage, foundations, geologic features

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overburden, surface subsidence damage, coal mining

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surface subsidence damage, roads

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ground control, room-and-pillar, bumps, longwall

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room-and-pillar, pillar extraction, coal mining

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overburden, subsurface water, mine waste, surface water

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surface structural damage, engineering, subsurface water, hydrology, geotechnical, coal mining, surface water

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hydrology, surface water
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backfilling, mine design, anthracite, coal mining
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angle of draw, surface structural damage, coal mining, geologic features

O'Rourke, J. E., R. M. Mabry, B. B. Ranson, K. O'Connor. Subsidence Monitoring Systems for Undermined Areas. Dep. Energy contract ET-76-C-01-9123, Woodward-Clyde, Consultants, 1977, 304 pp. NTIS FE/9123-1.

Major applications and specifications of subsidence monitoring systems are reviewed, and the relevant data measurements for a cost-effective monitoring program are identified for each. Seven sets of measurements are formalized as individual measurement systems. Availability, cost, and ease of use are listed for over 100 potentially useful instruments.

monitoring design, monitoring installation, monitoring equipment, survey methods, survey equipment, economics, instrumentation

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instrumentation, prediction, monitoring equipment, monitoring design, monitoring methods

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instrumentation, longwall, monitoring design, monitoring methods, monitoring equipment, active mines, coal mining

O'Rourke, J. E., K. M. O'Connor, P. H. Rey. Instrumentation Systems for Subsidence Monitoring of Longwall Panels. Chapter 21 in State-of-the-Art of Ground Control in Longwall Mining and Mining Subsidence, Soc. Min. Eng. AIME Fall Meeting, Honolulu, HI, Sept. 4-9, 1982. Soc. Min. Eng. AIME, Littleton, CO, 1982, pp. 235-244.

Evaluates construction and monitoring techniques for specific geotechnical instrumentation used to provide overburden and surface-subsidence data. Instrumentation for monitoring ground and subsurface deformations and mine-level stresses are discussed.

monitoring equipment, monitoring methods, monitoring design, survey equipment, geotechnical, longwall, overburden, monitoring installation, instrumentation

O'Rourke, J. E. Monitoring Subsidence in the West: Problems and Analysis. Chapter 13 in Workshop on Surface Subsidence Due to Underground Mining, S. S. Peng and M. Harthill, eds., Morgantown, WV, Nov. 30-Dec. 2, 1981. WV Univ., Morgantown, WV, Mar., 1982, pp. 164-179.

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monitoring design, monitoring installation, monitoring equipment, monitoring methods, survey methods, survey equipment

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monitoring installation, overburden, geologic features, geophysical methods

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longwall, geotechnical

O'Rourke, T. D., S. M. Turner. A Critical Evaluation of Coal Mining Subsidence Patterns. Proc., AIME Annual Meeting, New Orleans, 1979.

coal mining, prediction

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coal mining, monitoring methods, subsidence research

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Obert, L. Measurement of Pressures on Rock Pillars in Underground Mines. U.S. Bureau of Mines RI 3521, 1939-40.

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in situ testing, lab testing, pillar strength, metal mining

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rock mechanics, lab testing

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seismic, in situ testing, monitoring methods, monitoring equipment, pillar strength

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This study considered both massive formations mined with an arched roof and bedded formations with flat roofs. Designs pertain to efficient mineral extraction rather than the prevention of surface subsidence.

mine design, roof stability, tunnelling

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seismic, subsurface subsidence damage, monitoring methods

Obert, L. An Inexpensive Triaxial Apparatus for Testing Mine Rock. U.S. Bureau of Mines Rpt. 6332, 1963.

rock mechanics, lab testing

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modeling, pillar strength, non-metal mining, rock mechanics, lab testing

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rock mechanics, roof bolting, mine design, ground control, pillar strength, instrumentation

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mine design, pillar strength, coal mining

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mine design

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surface structural damage, survey data processing, survey methods, survey design

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longwall, mine design, coal mining

Oldroyd, D. C. Stopping Under An Overland Conveyor, Transvaal Navigation Collieries. SANGORM Symposium, Oct. 21, 1986, Sandton, South Africa, pp. 89-96. International Society for Rock Mechanics, South African National Group.

This paper describes the undermining of an overland conveyor belt, the measurements of surface subsidence taken and the results obtained. It also describes the effect of subsidence on the conveyor and the preventative measures that could have been taken to prevent the relatively minor

damage that was caused. Though the magnitude of the strains that occurred were very high the conveyor remained functional and carried coal throughout the undermining.

coal mining, pillar extraction, surface structural damage, monitoring methods, mitigation

Oravecz, K. I. Measurement of Surface Displacements Caused by Extraction of Coal Pillars. Proc., Conference on Large Ground Movements and Structures, Cardiff, Wales, July 4-7, 1977. Univ. of Wales Inst. of Sci. and Technol., Cardiff, Wales, 1977, pp. 60-85.

Summarizes the procedures used in a subsidence study conducted over a bord-and-pillar operation. Details are given on instrumentation used to determine surface subsidence, lateral displacements, and development and extent of the cave in relation to the mining geometry.

monitoring design, monitoring installation, monitoring equipment, survey methods, survey equipment, survey data processing, instrumentation, room-and-pillar, pillar extraction, coal mining

Oravecz, K. I. Analogue Modeling of Stresses and Displacements in Bord and Pillar Workings of Coal Mines. Int. J. Rock Mech. Min. Sci. and Geomech. Abstr., v. 14, 1977, pp. 7-23.

room-and-pillar, modeling, coal mining

Oravecz, K. I. Improved Prediction of Surface Subsidence Using the Influence Function Approach. SANGORM Symposium, Oct. 21, 1986, Sandton, South Africa, pp. 73-80. International Society for Rock Mechanics, South African National Group.

One of the shortcomings of the prediction of surface displacements resulting from caved tabular excavations at shallow and moderate depths stems from the lack of ability to estimate precisely the convergence or closure distribution. The development of a variety of numerical methods assist in the improved modeling of the complex mechanism of caving and the global response of the rock mass.

prediction, influence function, modeling, computer, finite element method, boundary element method

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Evaluates the amplitude of mine subsidence through the examination of method of mining, geological conditions, rate of face advance, time factors, and differing mining conditions. Refers to the partial subsidence curve, and how this curve can be used for practical applications.

vertical displacement, horizontal displacement, prediction, time factor, geologic features

Orchard, R. J. Surface Effects of Mining--The Main Factors. Colliery Guardian, v. 193, 1956.
surface subsidence damage

Orchard, R. J. Prediction of the Magnitude of Surface Movements. Colliery Eng., v. 34, 1957, pp. 455-462.

Examines various aspects of mine subsidence: the effects of backfilling on ground movements, geologic conditions, and an analysis of the relationship among subsidence, seam depth, and horizontal strain. Tensile strain, compressive strain, and the relationship of strain to slope are also evaluated.

vertical displacement, horizontal displacement, prediction, backfilling, geologic features

Orchard, R. J. Prediction of the Magnitude of the Surface Movement. Proc., European Congress on Ground Movement, Leeds, April, 1957.

prediction

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The various factors affecting surface movements are summarized and the manner in which they influence the shape of the subsidence trough is described. Discusses the importance of the width-depth ratio in determining the maximum amplitude of subsidence. Also included is a brief discussion of surface damage and methods for reducing this damage.

surface structural damage, mine design, backfilling, survey data processing

Orchard, R. J. The Effect of Mining Subsidence Upon Public Health Engineering Works. J. Inst. Public Health Eng., v. 56, 1957, pp. 188-204.

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Orchard, R. J. Underground Stowing. Colliery Guardian, v. 203, Aug. 1961, pp. 258-263.

Discusses requirements for maximum subsidence and briefly compares pneumatic and hydraulic backfilling methods. Compares cost of solid backfilling methods with damage produced by uncontrolled subsidence.

backfilling, economics

Orchard, R. J. Surface Subsidence Resulting From Alternative Treatment of Colliery Goaf. Colliery Eng., v. 41, Oct., 1964, pp. 428-435.

Compares surface subsidence caused by both total- and partial-extraction methods when allowing caving rather than using backfilling. Roadways and packs and their effects upon convergence are discussed in relation to "effective" panel width and maximum subsidence.

surface structural damage, mine design, backfilling, mine waste, partial extraction, longwall

Orchard, R. J. Partial Extraction and Subsidence. Min. Eng., London, v. 123, No. 43, April, 1964, pp. 417-430.

Subsidence and roof control are shown to be dependent upon the size of pillars in relation to the seam depth. With room-and-pillar workings, both safety and higher extraction can be obtained simultaneously only in shallow seams. With deeper seams, longwall partial extraction layouts are shown to produce greater mine safety and economical utilization of coal reserves.

partial extraction, roof stability, room-and-pillar, longwall, National Coal Board, mine safety, mine design, coal mining

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surface subsidence damage, survey methods, coal mining

Orchard, R. J. The Control of Ground Movements in Undersea Workings. Min. Eng., London, v. 128, No. 101, Feb., 1969, pp. 259-273.

Laws governing coal extraction under bodies of water were revised in an attempt by the National Coal Board to standardize coal extraction legislation and to promote maximum use of reserves.

hydrology, subsurface water, ground control, National Coal Board, law, coal mining

Orchard, R. J., W. S. Allen. Longwall Partial Extraction Systems. The Mining Engineer, London, v. 129, No. 117, June, 1970, pp. 523-535.

Suggests an improved method for calculation of maximum subsidence, taking width and depth into account separately instead of combining them into a width/depth ratio. Examines the mechanics of harmonious extraction.

longwall, partial extraction, prediction

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pipelines, utilities

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Discusses National Coal Board guidelines for undersea coal extraction.

subsurface water, monitoring design, mine design, National Coal Board, coal mining

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surface water, subsurface water, mine design, hydrology, coal mining

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pillar strength, ground control, coal mining

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rock mechanics, coal mining

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bumps, geologic features

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mine operation, mine design, coal mining

Otto, J. B. The Effect of Total Extraction Coal Mining on Transmission Towers. SANGORM Symposium, Oct. 21, 1986, Sandton, South Africa, pp. 59-72. International Society for Rock Mechanics, South African National Group.

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modeling, prediction, computer, surface structural damage, foundations, longwall, coal mining, monitoring methods

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roof stability, geologic features

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surface structural damage, soil mechanics, floor stability

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rock mechanics, instrumentation, in situ testing, seismic

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economics, backfilling

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modeling, mine design, longwall, coal mining, pillar strength

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backfilling, abandoned mines, economics

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surface structural damage, monitoring design, survey design, mine operation, longwall, coal mining

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longwall, coal mining, rock mechanics, modeling

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vertical displacement, surface structural damage, prediction, coal mining

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room-and-pillar, surface structural damage, coal mining

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This paper is a summary document of five previously published papers on subsidence over 24 longwall panels and 5 room-and-pillar sections in the northern Appalachian coalfield. It includes the physical characteristics of 54 surface subsidence profiles collected for longwall and room-and-pillar mining. Empirical and analytical methods of prediction and modeling are discussed in detail.

vertical displacement, surface structural damage, longwall, room-and-pillar, prediction, modeling

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longwall, mine design
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prediction, subsidence research

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modeling, vertical displacement, geologic features

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room-and-pillar, coal mining, overburden

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prediction, survey methods, monitoring methods

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pillar strength, longwall, coal mining

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prediction, tunnelling

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subsurface water, coal mining, geologic features

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fluid extraction, soils

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overburden, coal mining

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longwall, modeling

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Various measurements were made to determine the effectiveness of backfilling methods, as well as to determine the effect of subsidence on roof strata.

backfilling, subsurface subsidence damage, overburden, roof stability

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Surface subsidence monitoring above total extraction coal mine workings was conducted by 'Radial Precision Survey' method, using a theodolite and an electronic distance meter. The paper concludes that this method meets all the requirements of modern subsidence monitoring, and should therefore replace precise leveling where ever possible.

survey methods, survey equipment, survey data processing, monitoring methods, monitoring equipment, profile function, horizontal displacement, vertical displacement, coal mining, computer, geophysical methods

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hydrology, subsurface water, fluid extraction

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backfilling, mine waste

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coal mining, floor stability, roof stability, rock mechanics, mine design, mathematical modeling

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roof support, ground control

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overburden, coal mining

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Serata, S., B. H. Gardner. Prediction and Design Control of Surface Subsidence by Global Simulation of Mine Behavior Using Finite Element Model. Proc., 2nd Workshop on Surface Subsidence due to Underground Mining, Morgantown, WV, June 9-11, 1986, S. S. Peng, ed. WVU Dept. of Mining Engineering, Morgantown WV, Aug., 1986.

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finite element method, mine design, computer, modeling, prediction

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ground control

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mine design, mine operation, surface structural damage, mitigation, coal mining, land-use planning, geologic features

Shadbolt, C. H., B. N. Whittaker, D. J. Forrester. Recent Developments in Mining Subsidence Engineering. Paper presented at the 64th General Meeting of the Midland County Mineral Division of the RICS, Nottingham, Oct. 19, 1973.

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prediction, survey methods, instrumentation, geologic features

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surface structural damage, engineering

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Discusses various subsidence parameters and their effects as they relate to mine extraction dimensions; explains various means of reducing subsidence damage. Also included is a historical review of the theories and work by early subsidence investigators.

vertical displacement, horizontal displacement, surface structural damage, subsurface structural damage, survey data processing, engineering, historical, prediction theories

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surface subsidence damage

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prediction, coal mining

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fluid extraction, geologic features

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Model sandstone pillars were used in laboratory compression tests. The concluding theory was that average width rather than least width is important in determining pillar strength.

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ground control, instrumentation, roof stability

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mine design, ground control, longwall, roof stability

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abandoned mines, surface structural damage, horizontal displacement, foundations, prediction, influence function, coal mining, architecture

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floor stability, longwall

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longwall, modeling
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surface structural damage, engineering
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survey design, survey methods, coal mining
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backfilling, coal mining

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surface subsidence damage, subsurface subsidence damage, environment, prediction

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land-use planning, partial extraction, backfilling, room-and-pillar, surface structural damage, law, ground control

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hydrology, agriculture, environment, land-use planning, surface subsidence damage, subsurface water, surface water, coal mining

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law, surface subsidence damage, surface water, subsurface water, hydrology, agriculture, environment, land-use planning, coal mining

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subsurface water, prediction, modeling

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partial extraction, surface subsidence damage

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vertical displacement, horizontal displacement, backfilling, angle of draw

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backfilling, economics, angle of draw

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modeling, longwall
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A numerical procedure based on the nonlinear finite element analysis has been developed for the prediction of subsidence profiles over longwall mine panels. The behavior of the overburden rock was modelled by using an elasto-plastic constitutive model.
finite element method, modeling, prediction, longwall, elastic theory, overburden
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mine operation, ground control, overburden, roof support, coal mining
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mine design, mine operation, ground control

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vertical displacement, horizontal displacement, subsurface water, mine design, prediction, surface subsidence control, coal mining, geologic features

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reclamation, overburden, coal mining, monitoring installation, mine design

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historical, coal mining

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rock mechanics, pillar strength, mine design, lab testing, coal mining

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mine operation, coal mining, active mines

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coal mining, surface water, subsurface water

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engineering, construction, surface structural damage, abandoned mines

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vertical displacement, horizontal displacement, law, land-use planning, government, insurance, construction, mine operation, land values

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monitoring equipment, monitoring methods, multiple-seam extraction, coal mining, pillar strength

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ground control, metal mining

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subsurface structural damage, soil mechanics, engineering

Spanovich, M. Construction Over Shallow Mines: Two Case Histories. Pres. at ASCE Structural Eng. Div. Meeting, Pittsburgh, PA, Sept. 30-Oct. 4, 1968. Preprint 703, New York, 10 pp.

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engineering, construction, economics, roof support

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coal mining

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floor stability, geologic features, coal mining

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floor stability, ground control, geotechnical, coal mining, geologic features

Speck, R. C., R. W. Bruhn, R. E. Gray. Instrumentation Plan for Monitoring Ground Movements Associated With Pillar Extraction Mining at the Kitt No. 1 Mine in Northern West Virginia. Chapter 19 in Workshop on Surface Subsidence Due to Underground Mining, S. S. Peng and M. Harthill, eds., Morgantown, WV, Nov. 30-Dec. 2, 1981. WV Univ., Morgantown, WV, Mar. 1982, pp. 231-236.

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monitoring design, monitoring installation, monitoring equipment, instrumentation, room-and-pillar, pillar extraction

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prediction, overburden

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vertical displacement, longwall, prediction, survey data processing, geologic features, coal mining

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survey data processing, prediction, longwall, geologic features, coal mining

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roof stability, prediction, overburden, coal mining

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finite element method, pillar strength, computer, coal mining, modeling, mine design

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land-use planning, engineering, abandoned mines, coal mining

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law, government, coal mining

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rock mechanics, pillar strength, National Coal Board, lab testing, coal mining

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subsurface subsidence damage

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engineering, roof support, tunnelling

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engineering, soil mechanics

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mine operation, mine design, floor stability

Theodore Barry and Associates. Industrial Engineering Study of Hazard Associated with Underground Coal Mine Production. Final Report to U. S. Bureau of Mines, v. 1, 1971, 298 pp.

mine design, ground control, mine safety, coal mining, engineering

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ground control, bumps, monitoring methods

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States that subsidence due to oil and gas removal is probably limited to oil fields in relatively young formations where the oil comes from loosely cemented sands or from oil-soaked clays.

oil extraction, geologic features

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engineering, construction, surface structural damage

Thomas, E., A. J. Barry, A. Metcalf. Suspension Support Progress Report. U.S. Bureau of Mines IC 7533, 1949, 13 pp.

roof support

Thomas, E. Conventional Timbering Versus Suspension Supports. U.S. Bureau of Mines B 489, 1950, pp. 175-181.

roof stability, roof support, mine design

Thomas, J. L. An Introduction to Mining--Exploration, Feasibility, Extraction, Rock Mechanics. Holstead Press, New York, 1978.

rock mechanics, mine design

Thomas, L. J. The Effects of Adjacent Seams and Method of Working on Roadway Closure in the Main Bright Seam at Hucknell Colliery. NCB-MRE Report No. 2330, June, 1968.

mine operation, multiple-seam extraction, National Coal Board, coal mining

Thomas, L. J. Effect of Adjacent Seams and Methods of Working in the Main Bright Seam at Hucknell Colliery. Colliery Guardian, v. 218, No. 4, 1970, pp. 186-195.

mine operation, multiple-seam extraction, National Coal Board, coal mining

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mine operation, mine design

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surface structural damage, surface subsidence damage

Thorneycroft, W. The Effect on Buildings of Ground Movement and Subsidence Caused by Longwall Mining. Trans., AIME, v. 94, 1931, pp. 51-68.

longwall, surface structural damage

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subsurface water, coal mining, hydrology

Tilton, J. G. The Effect of Subsidence on Pipelines. Pres. at Soc. Min. Eng. AIME Annu. Meeting, New York, NY, Feb. 27-Mar. 3, 1966. Soc. Min. Eng. AIME preprint 66FM41, 34 pp.

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subsurface structural damage, pipelines, utilities

Tincelin, E., P. Sinou. Observation Made in the Lorraine Iron Ore Mines. Proc., European Congress On Ground Movement, Leeds, England, Apr. 9-12, 1957. London Harrison, 1957, pp. 128-140.

metal mining

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ground control

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pillar extraction, room-and-pillar, metal mining, pillar strength, surface subsidence damage, mine safety, rock mechanics, ground control

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Describes the substitution of hydraulically-emplaced unclassified tailings for previous dry filling techniques for more efficient stope filling.

backfilling

Tomlinson, M. J. Foundation Design and Construction. Pitman Press, 4th Edition, 1980.

engineering, foundations, construction, surface structural damage

Tousell, J., C. Rich, Jr. Documentation and an Analysis of a Massive Rock Failure at the Bautsch Mine, Galena, Ill. U.S. Bureau of Mines RI 8453, 1980, 49 pp.

Townsend, J. M., W. C. Jennings, C. Haycocks, G. M. Neall, L. P. Johnson. A Relationship Between the Ultimate Compressive Strength of Cubes and Cylinders for Coal Specimens. 18th U.S. Symposium on Rock Mechanics, Keystone, CO, 1977, pp. 4A6-1--4A6-6.

rock mechanics, pillar strength, lab testing, coal mining

Transactions of the Institution of Mining Engineers. A Simple Method of Water Stowage Employed at No. 5 Pit at the Escerpelle Mines. v. 35, 1908, p. 79.

Details a modification of hydraulic backfilling in which fill is transported by mine car to the working level, where it is mixed with water and flushed to the required areas.

backfilling

- Traughber, E. B., J. O. Snowden, W. B. Simmons. Differential Subsidence on Reclaimed Marshland Peat in Metropolitan New Orleans, Louisiana. Internat. Conf. on Evaluation and Prediction of Subsidence, Pensacola Beach, Fla., Jan., 1978. Publ. as Evaluation and Prediction of Subsidence, S. K. Saxena, ed., ASCE, New York, 1979, pp. 479-499.
land-use planning, prediction, fluid extraction
- Trent, B. C. A Computerized Subsidence Model. Pres. at Soc. Min. Eng. Annu. Meeting, New Orleans, LA, Feb. 18-22, 1979. Soc. Min. Eng. AIME preprint 79-86, 11 pp.
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vertical displacement, horizontal displacement, computer, modeling
- Trent, B. C. Empirical Continuum and Block Caving Computer Models for Surface Subsidence. Chapter 10 in Workshop on Surface Subsidence due to Underground Mining, S. S. Peng and M. Harthill, eds., Morgantown, WV, Nov. 30-Dec. 2, 1981. WV Univ., Morgantown, WV, Mar. 1982, pp. 142-146.
computer, modeling
- Trischka, C. Subsidence Following Extraction of Ore From Limestone Replacement Deposits, Warren Mining District, Bisbee, Arizona. Trans., AIME, v. 109, 1934, pp. 173-180.
non-metal mining
- Trojanowski, K. Analityczne Sposoby Wyznaczania Wektorow Przesuniec Poziomych Punktow Terenow Gorniczych Przy Wykorzystaniu Metod Malej Triangulacji (Vectors of Points on Undermined Surface by Application of "Small Triangulation" Technique). Przegl. Gorn., v. 27, No. 2, 1971, pp. 65-70.
modeling
- Trojanowski, K. Application of the Segment Network of Even Effects for Calculation of Subsidence According to K. Kochmanski Theory. 1974, 39 pp. NTIS TT74-54015.
Details the application of the K. Kochmanski theory of a network nomogram to the calculation of subsidence over a horizontally extending coal seam. The text is translated from Polish to English.
vertical displacement, horizontal displacement, prediction theories, prediction, coal mining
- Tubby, J. E., I. W. Farmer. Stability of Undersea Workings at Lynemouth and Ellington Collieries. Min. Eng., London, v. 141, Aug., 1981, pp. 87-96.
surface water, subsurface water
- Turnbull, D., E. L. J. Potts. Surface and Underground Subsidence Correlation. Colliery Eng., v. 35, No. 2, Feb., 1958, pp. 65-72.
Describes a series of leveling stations at the surface and in five underlying coal seams, which were to be used as a framework for more detailed leveling operations.
surface subsidence damage, survey design, coal mining, survey methods, multiple-seam extraction
- Turney, J. E. Colorado Geological Survey's Role and Responsibility - Abandoned Mine Subsidence Hazards. Proc., 1985 Conf. on Coal Mine Subsidence in the Rocky Mountain Region, Colorado Springs, CO, Oct. 28-30, 1985, J. L. Hynes, ed., pp. 19-23. Colorado Geological Survey Special Publication 31, Department of Natural Resources, Denver, CO, 1986.
The Colorado Geological Survey's responsibilities regarding inactive mine subsidence hazards are mandated by state statutes that created the present Survey in 1967 and Colorado land use laws enacted between 1972 and 1974. These laws set the stage for the Survey's review of subsidence investigations, the development of a subsidence information library which includes reports of subsidence investigations, extent of mining maps, and publications.
law, abandoned mines, land-use planning, reclamation, literature search
- Tweedy, D. H. Recent Developments in Pneumatic Conveying. Paper presented at Pacific Northwest Metals and Minerals Conference, AIME, April 14, 1973.
Describes the uses of pneumatic conveying backfilling.
backfilling, mine fires
- U.S. Army Engineer District (Baltimore, MD) Northeast Flood Study, Susquehanna River Basin Flood Control and Mine Subsidence in Wyoming Valley, Pennsylvania. 1971, 35 pp. NTIS PB 207 567-D.
hydrology, surface water
- U.S. Bureau of Mines. Final Environmental Statement. Demonstration of Hydraulic Backfilling of Mine Voids, Scranton, Pennsylvania. 1972, 95 pp. NTIS FES 72-11.
environment, backfilling
- U.S. Bureau of Mines. Rock Mechanics Instrumentation for Mine Design. U. S. Bureau of Mines IC 8585, 1973, 76 pp.
ground control, instrumentation, rock mechanics, mine design

U.S. Bureau of Mines. Ground Control Aspects of Coal Mine Design. Proc., U.S. Bureau of Mines Technology Transfer Seminar, Lexington, KY, 1973, U.S. Bureau of Mines IC 8630, 1974, 138 pp.
mine design, ground control, coal mining

U.S. Bureau of Mines. Investigation of Subsidence in Farmington, Marion County, West Virginia. U.S. Bureau of Mines Mineral Resources and Environmental Development, Feb., 1974.
surface subsidence damage

U.S. Bureau of Mines. Pumped-Slurry Backfilling of Inaccessible Mine Workings for Subsidence Control. U.S. Bureau of Mines IC 8667, 1975.
backfilling, abandoned mines, ground control

U.S. Bureau of Mines. Surface Subsidence Control in Mining Regions. Final Environmental Statement, FES 76-58, Nov. 5, 1976, 90 pp., App. A and B.
ground control, environment

U.S. Bureau of Mines. 1976 Census of Operating American Longwall Installations. Coal Age, January 1977, pp. 99-107.
mine design, longwall, ground control, coal mining

U.S. Bureau of Mines Staff. Mine Subsidence Control. Proc., U.S. Bureau of Mines Technology Transfer Seminar, Pittsburgh, PA, Sept. 19, 1985, U.S. Bureau of Mines IC 9042.

Four papers are included, with topics on: effects of subsidence on water table levels, development of subsidence precalculation methodology suitable for use with the specific lithological conditions of the Pittsburgh coalbed, an engineering comparison of technologies used in surveying for longwall mine subsidence, and a comparison of the process of subsidence over 2 different longwall panels. The Bureau of Mines conducted research to develop accurate techniques of subsidence prediction which are tailored to geologic conditions specific to the United States.
prediction, engineering, longwall, monitoring equipment, monitoring design, monitoring methods, survey methods, survey equipment, survey design, subsurface water, hydrology, geologic features

U.S. Bureau of Reclamation. Hydraulic Model Studies for Backfilling Model Cavities. Second Series of Tests, REC-ERC-75-3, March, 1975.
backfilling, modeling

U.S. Code of Federal Regulations. Title 30--Mineral Resources; Chapter VII--Office of Surface Mining Reclamation and Enforcement, Department of the Interior; Subchapter K--Permanent Program Performance Standards; Part 817--Underground Mining Activities. July 1, 1984.
reclamation, law

U.S. Code of Federal Regulations. Title 30--Mineral Resources; Chapter VII--Office of Surface Mining Reclamation and Enforcement, Department of the Interior; Subchapter G--Permanent Program Performance Standards; Part 783--Underground Mining Permit Applications--Minimum Requirements for Information on Environmental Resources. July 1, 1984.
mine operation, law, reclamation, environment, government

U.S. Congress. Surface Mining Control and Reclamation Act of 1977. Public Law 95-87, Aug. 3, 1977, 91 Stat. 4; 30 U.S.C. 1201, et seq.

This law authorized Federal regulations for reclaiming and revegetating surface areas of underground and surface coal mines.
reclamation, mine operation, law, government, coal mining

U.S. Department of Agriculture, Forest Service. Mining in National Forests, Regulations to Protect Surface Resources. Washington, D.C., 1975, Current Information Report No. 14, 20 pp.
law, environment, government

U.S. General Accounting Office. Alternatives to Protect Property Owners From Damages Caused by Mine Subsidence. Rep. CED-79-25, Feb. 14, 1979, 50 pp. NTIS PB 290 869.

Presents an overview of the U.S. experience with subsidence and its economic and social effects. Legislation at the Federal, State, and local levels is briefly discussed, as is the relationship between partial- and total-extraction mining methods and resulting surface subsidence. Examines 5 possible alternatives for protecting property owners from financial hardship due to mine subsidence.

surface structural damage, mine design, law, insurance, partial extraction, economics

U.S. Government. 1969 Coal Mine Health and Safety Act. Code of Federal Regulations, v. 30, Mineral Resources, rev. 1974, pp. 342-349.
coal mining, mine design, mine operation, ground control, mine safety, roof bolting, law

Udd, J. E., H. Wang. A Comparison of Some Approaches to the Classification of Rock Masses for Geotechnical Purposes. Proc., 26th U.S. Symp. on Rock Mechanics, Rapid City, SD, June 26-28, 1985, E. Ashworth, ed., pp. 69-78.

Rock mass classification systems permit comparison of conditions at a site with those described elsewhere. This study, conducted at a mine in the province of Quebec, used four different approaches to classification systems in order to obtain numerical values which are possible indicators of the qualities of local conditions in the rock mass.

rock mechanics, geotechnical, mine design

United Nations. Symposium on Coal and Gas Outbursts. Nimes, France, Nov. 25-27, 1964. Publ. 1967, 289 pp.

ground control, bumps, coal mining

University of Illinois, Urbana, IL. Mine Subsidence and Building Damage. Energy Rep., Office of Energy Res., June, 1982, 2 pp.

surface structural damage

Unrug, K. F. Longwall Support Requirements. Journal of Mines, Metals & Fuels, Sept., 1983, Special Number on Update on Longwall Mining--Evolving Trends, pp. 334-344.

Planning of the longwall operation should take into account many factors such as seam thickness, dip, depth, roof and floor conditions, fractures pattern, etc.

longwall, roof stability, roof support, mine operation, geologic features, coal mining

Urban Redevelopment Authority, Pittsburgh, PA. Evaluation of Mine Subsidence, Neighborhood Development Program, Webster-Elba and Roberts-Devilliers Project Action Areas. Mar., 1973, 23 pp.

surface structural damage

Utah Board and Division of Oil, Gas, and Mining. Coal Mining and Reclamation Permanent Program, Chapter 1. Final Rules. Rev. Sept. 20, 1982, 300 pp.

Contains information concerning the regulations pertaining to surface effects of underground coal mining activities in Utah.

law, surface subsidence damage, government, reclamation, mine operation, coal mining

Utah Geological and Mining Survey. Subsidence Episodal. Survey Notes, 1981, 2 pp.

Vaclav, S. A Study of Rock Movements in Long Wall Mining in Lignite Seams. Uhli, Sept. 9, 1955.

longwall

Van Besien, A. C. Analysis of Roof Fall Accident Statistics and its Application to Roof Control Research. Paper presented at the AIME Annual Meeting, Chicago, IL, Feb. 25-March 1, 1973. Preprint No. 73-F-71, 11 pp.

roof support, roof stability, ground control, mine safety

van der Merwe, J. N. Design Methods to Arrive at the Optimal Placing and Mining of Inter Panel Pillars to Alleviate Their Effects on Surface. SANGORM Symposium, Oct. 21, 1986, Sandton, South Africa, pp. 133-144. International Society for Rock Mechanics, South African National Group.

Current longwall panels normally incorporate the leaving of inter-panel pillars. These pillars are sometimes the cause of water accumulations on the surface. A method is described whereby the dimensions of crush pillars can be determined which do not have the same adverse effects on the surface.

pillar strength, coal mining, mine design, longwall, modeling, yielding supports, computer, multiple-seam extraction, surface structural damage, surface water, agriculture

van der Merwe, J. N. Analysis of Surface Subsidence Over a Longwall Panel at 50m Below Surface. SANGORM Symposium, Oct. 21, 1986, Sandton, South Africa, pp. 145-150. International Society for Rock Mechanics, South African National Group.

Longwall coal mining in South Africa tends to occur at depths of around 100m below the surface. Very few shallow cases are available for analysis. The paper describes the results of an analysis of a longwall panel which was mined at a depth of 50m. It was found that the normalized surface strains did not deviate significantly from the expected values, while significantly greater tilts developed. There were also major differences between the dynamic and static profiles.

longwall, surface subsidence damage, coal mining

Van der Molen, W. H. Subsidence of Peat Soils After Drainage. Int. Assoc. Hydrol. Sci., Stud. Rep. Hydrol., No. 19, 1975, pp. 183-186.

fluid extraction, soils

Van Dillen, D. E. Three-Dimensional Finite Element Analyses of Single- and Double-Entry Portions of Sunnyside Mine No. 1. Report No. R-7638-4534, submitted to U.S. Bureau of Mines, El Segundo, CA, Oct., 1978, 275 pp.

finite element method, modeling, coal mining

Van Dorpe, P. E., M. R. Howes, M. J. Miller, S. J. Lenker. Underground Mines and Related Subsidence Potential, What Cheer, Iowa. Iowa Geological Survey OFR 84-3, 1984, Iowa City, IA.

Numerous subsidence events above underground mines have been reported in Iowa. This report was prepared from extant coal mine information to assist in evaluation of subsidence events and to serve as a research base.

historical, room-and-pillar, longwall, surface structural damage, agriculture, abandoned mines

Van Eeckhout, E. M., S. S. Peng. The Effect of Humidity on the Compliance of Coal Mine Shales. Int. J. Rock Mech. Min. Sci. Geomech. Abstr., v. 12, No. 11, 1975, pp. 335-340.

rock mechanics, ground control, coal mining, roof stability

Van Eeckhout, E. M. The Mechanisms of Strength Reduction Due to Moisture in Coal Mine Shales. International Journal of Rock Mechanics, Mining Science, and Geomechanical Abstracts, v. 13, 1976, pp. 61-67.

rock mechanics, roof stability, coal mining

Van Heerden, W. L. Stress Measurements in Coal Pillars. Proc., 2nd Int. Congr. Rock Mech., 1970, Paper No. 4-16, 5 pp.

pillar strength, ground control, rock mechanics, coal mining

Van Heerden, W. L. In-Situ Determination of Complete Stress-Strain Characteristics for 1.4 M Square Coal Specimens With Width to Height Ratios of Up to 3.4. Counc. Sci. Ind. Res., S. Afr. Rept., No. ME 1265, 1975, 30 pp.

pillar strength, rock mechanics, ground control, in situ testing, coal mining

Van Voast, W. A., R. B. Hedges. Hydrogeologic Conditions and Projections Related to Mining near Colstrip, Southeastern Montana. Montana Bureau of Mines and Geology, Billings, MT, 1975.

environment, hydrology

Van Wagenen, T. F. International Mining Law. McGraw-Hill, 1st ed., 1918, 342 pp.

law

Vandale, A. E. Subsidence--A Real or Imaginary Problem? Min. Eng., v. 19, Feb., 1967, pp. 86-88.

Presents a brief history of coal mining and surface protection in the Pittsburgh, PA, area. Some of the regulations covering surface protection are included.

historical, law, coal mining

Vanderwilt, J. W. Ground Movement Adjacent to a Caving Block in the Climax Molybdenum Mine. Trans., AIME, v. 181, 1949, pp. 360-370.

Varlashkin, V. M. Dopustimye Deformatsii Zemnoi Poverkhnosti Pri Razrabotke Ugol'Nykh Plastov Pod Grazhdanskimi Zdaniyami (Permissible Deformations of Land Surface During Working of Coal Seams Under Civil Buildings). Izv. Vyssh. Uchebn. Zaved. Gorn. ZH., No. 8, 1975, pp. 39-43.

surface structural damage, government, engineering, coal mining

Varlashkin, V. M. Evaluation of the Flexural Rigidity of Buildings in the Case of Differential Settlements of Foundation Beds Above Mines. Soil Mech. Found. Eng., U.S.S.R., v. 12, No. 3, May/June, 1975, pp. 171-173.

surface structural damage, engineering, overburden, foundations

Vasil'Ev, M. P. Usadka Zakladochnykh Massivov Pod Davleniem (Subsidence of Packing Rocks Under Pressure). Karaganda Sci. Res. Inst., U.S.S.R., UGOL', No. 12, 1976, pp. 8-11.

backfilling

Vega, G. E. F. Subsidence of the City of Mexico: A Historical Review. Proc., 2nd Internat. Symp. on Land Subsidence, Anaheim, CA, Dec. 13-17, 1976. Internat. Assoc. of Hydrological Sciences, Pub. No. 121, Washington, D.C., 1977, pp. 35-38.

historical, surface subsidence damage

Veith, D. L., K. L. Bickel, R. W. E. Hopper, M. R. Norland. Literature on the Revegetation of Coal-Mined Lands: An Annotated Bibliography. U.S. Bureau of Mines IC 9048, 1985, 296 pp.

This document consists of an 805-reference bibliography of U.S. and Canadian literature which pertains to revegetating coal-mined lands. All references are annotated and evaluated by keywords.

reclamation, literature search, environment, land-use planning, coal mining

Veith, D. L. Mined Land Subsidence Impacts on Farmland With Potential Application to Illinois: A Literature Review. U.S. Bureau of Mines IC 9124, 1987, 16 pp.

Summarizes a Bureau of Mines review of selected literature on the effects of subsidence due to high-extraction underground coal mining on farmland areas. The data are presented for

consideration in evaluating the subsidence effects due to similar mining techniques on the prime farmland areas of Illinois.

agriculture, surface subsidence damage, literature search, subsurface water, surface water, soils, mitigation, room-and-pillar, longwall, prediction, coal mining

Vine, W. A. Proceedings of the Symposium on Hydraulic Fill. Montana School of Mines, Butte, MT, 1958, 155 pp.
backfilling

VNIMI (General Institute of Mining Surveying) The Movements of the Rock Masses and of the Surface in the Main Coal Fields of the Soviet Union. Ugletekhizdat, Moscow, 1958, 250 pp. (in Russian).
coal mining

Voight, B., W. Pariseau. The Nature of Prediction in Subsidence Engineering. Pres. at ASCE Conf., New York, NY, Oct. 1968. ASCE Preprint 762, 42 pp.
prediction

Voight, B., A. C. Samuelson. On the Application of Finite-Element Techniques to Problems Concerning Potential Distribution and Stress Analysis in the Earth Science. Pure and Applied Geophysics, v. 75, No. 4, 1969, pp. 157-172.
finite element method, modeling

Voight, B., H. D. Dahl. A Post-Yield Phenomenological Approach to Mine Subsidence. Pres. at Int. Sci. Symp. on Mine Surveying, Min. Geol., and the Geometry of Miner. Deposits, Aug. 26-30, 1969, Prague, Czechoslovakia, Sec. III, Conf. Paper III/3, 12 pp.

Voight, B., W. Pariseau. State of Predictive Art in Subsidence Engineering. ASCE J. Soil Mech. Foundations Div., v. 96, No. SM2, Mar., 1970, pp. 721-750.

Gives a qualitative review of existing approaches to subsidence prediction; specific sections deal with both empirical and phenomenological methods. Also discussed are damage prediction and alleviation, with details on engineering design precautions and surface considerations.

vertical displacement, horizontal displacement, surface structural damage, subsurface structural damage, mine design, prediction, ground control, prediction theories

Von Schonfeldt, H., F. D. Wright, K. F. Unrug. Subsidence and Its Effect on Longwall Mine Design. Min. Congr. J., v. 66, No. 5, 1980, pp. 41-45, 53; also, presented at the Annual AMC Coal Convention, St. Louis, MO, 1979, May 20-23.

Examines the characteristics of subsidence resulting from longwall extractions. From 1969 to 1979, longwall mining of coal in the U.S. expanded from about 13 faces to over 75. The main advantage of longwall mining, which is high extraction even at great depth, also can cause significant surface movements. New regulations in the U.S. covering coal mining subsidence and reclamation operations require the mine operator to take certain steps in mine design. Specific sections qualitatively discuss the caving of strata, the effect of panel width and depth on settlement, and considerations governing panel design.

mine design, monitoring design, monitoring installation, monitoring equipment, longwall, economics, coal mining, modeling, prediction, roof stability, National Coal Board, survey design, law

Vongpaisal, S. Prediction of Subsidence Resulting from Mining Operations. Ph.D. Thesis, McGill Univ., Montreal, Canada, 1973.
prediction

Vormberge, G. Working-Out a Seam in the Shaft Safety Pillar of a Pit Under Exceptionally Difficult Operating Conditions. Internat. Strata Control Cong., Essen, W. Germany, 1956.
mine operation, pillar extraction, room-and-pillar

Vorster, G. J. P. Contractual Aspects to be Addressed in the Application of High Extraction Underground Coal Mining Methods Resulting in Surface Ground Movement. SANGORM Symposium, Oct. 21, 1986, Sandton, South Africa, pp. 151-155. International Society for Rock Mechanics, South African National Group.

Research into the effects of high-extraction mining on the land surface and structures is gaining momentum but considerable research is still required to bridge the information gap. Negotiating mining and other contracts related to high-extraction mining under structures and land surfaces is a sound method of preventing problems in a field where many obstacles and pitfalls prevail.

law, surface structural damage, high-extraction retreat, longwall, pillar extraction, coal mining

Wade, L. V., A. J. Kwitowski, J. F. Judeikis. Investigation of Full Column Resin Bolt Reinforcement Mechanisms. Proc., 6th Int. Strata Control Conf., Banff, Canada, Sept., 1977, 19 pp.
roof bolting

- Wade, L. V., P. J. Conroy. Rock Mechanics Study of a Longwall Panel. Society of Mining Engineers Fall Meeting, St. Louis, MO, 1977, Preprint No. 77-1-391.
rock mechanics, longwall
- Wade, L. V., P. J. Conroy. Rock Mechanics Study of a Longwall Panel. Min. Eng., v. 32, No. 12, 1980, pp. 1728-1734.
rock mechanics, longwall
- Wagner, C. B. A Report on Subsidence Literature Survey, and the Law on Subjacent Support. WV Univ. Bull., Series 42, No. 1-I, July 1941, 60 pp.
law, literature search
- Wagner, H., M. D. G. Salamon. Strata Control Techniques in Shafts and Large Excavations. Association of Mine Managers of South Africa Papers and Discussions, v. 1972-1973, 1972, pp. 123-140.
ground control
- Wagner, H. Determination of the Complete Load Deformation Characteristics of Coal Pillars. Proc., 3rd International Congr. Rock Mech., Denver, CO, 1974, v. 11-8, pp. 1076-1082.
pillar strength, ground control, rock mechanics, coal mining
- Waite, B. A. Ground Water Monitoring of Underground Coal Mines. Min. Eng., Littleton, CO, v. 34, 1982, pp. 170-171.
hydrology, subsurface water, monitoring design, coal mining, monitoring methods
- Walker, H. C. SPR Geotechnical Program Preliminary Long-Term Monitoring Plan. Sandia Natl. Labs, Aug., 1980, 27 pp. NTIS SAND80-1750.
geotechnical, instrumentation, monitoring design, monitoring methods
- Walker, J. S., J. B. Green, M. A. Trevits. A Case Study of Water Level Fluctuations Over a Series of Longwall Panels in the Northern Appalachian Coal Region. Proc., 2nd Workshop on Surface Subsidence due to Underground Mining, Morgantown, WV, June 9-11, 1986, S. S. Peng, ed. WVU Dept. of Mining Engineering, Morgantown WV, Aug., 1986.
The purpose of this work was to provide detailed information which could be used to predict certain hydrologic effects of longwall mining in the Northern Appalachian Coal Region. Results of this case study indicate that water level fluctuations in the local groundwater system above longwall panels is associated with subsidence and that the static water level will generally reestablish at or near the pre-mining elevation after mining is completed.
subsurface water, law, coal mining, longwall, hydrology, geologic features
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vertical displacement, horizontal displacement, mine design, survey methods, mathematical modeling, surface structural damage

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modeling, prediction, surface subsidence damage

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mine design, longwall, ground control, mine waste, mine operation

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backfilling, mine waste, abandoned mines, active mines, coal mining

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subsurface water, fluid extraction, coal mining

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roof support, backfilling, roof bolting, coal mining, metal mining

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roof bolting

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shortwall, rock mechanics

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surface structural damage, engineering, geotechnical, insurance, monitoring methods, survey methods, coal mining

Yarbrough, R. E. Digitilt Tiltmeter System Utilized to Monitor Structural Response to Ground Movements Induced by Coal Mine Subsidence. The Indicator, v. 15, No. 1, 1986, Slope Indicator Co., Seattle, WA, p. 6.

The Illinois Mine Subsidence Insurance Fund and the U.S. Bureau of Mines, Twin Cities Research Center have chosen the Digitilt Tiltmeter as an instrument to monitor structural response to ground movements induced by coal mine subsidence. The Fund and the Bureau sponsored a program to construct and monitor two 30x40 ft foundations in front of a high-extraction panel in Sesser, IL.

foundations, monitoring equipment, computer, surface structural damage, high-extraction retreat, monitoring methods, coal mining

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fluid extraction, oil extraction

Yokel, F. Y. Guidelines for Housing Construction in Mine Subsidence Areas. Proc., International Conference on Evaluation and Prediction of Subsidence, Pensacola Beach, FL, Jan. 15-20, 1978. ASCE, New York, 1978, pp. 129-139.

engineering, construction, prediction, surface structural damage

Yokel, F. Y., L. A. Salomone, R. M. Chung. Construction of Housing in Mine Subsidence Areas.

Geotechnical Eng. Group, Structural and Material Div. Center for Building Technol., Natl. Eng. Lab., Natl. Bureau of Standards, Jan. 1981, 24 pp. NTIS NBSIR 81-2215.

Evaluates criteria for site exploration and development, risk assessment, and housing construction in areas of actual and potential mine subsidence. Suggested measures to mitigate damage to housing are also given. The appendix explains a mathematical model which can be used for the prediction of subsidence profile characteristics.

vertical displacement, horizontal displacement, surface structural damage, surface subsidence control, construction, mathematical modeling, prediction, engineering

Yokel, F. Y., L. A. Salomone, R. E. Gray. Housing Construction in Areas of Mine Subsidence. Natl. Bureau of Standards, J. Geotech. Eng. Div., v. 108, No. GT9, Sept., 1982, pp. 1133-1149.

engineering, construction, prediction, surface structural damage

Young, C. M. Subsidence Around a Salt Well. Trans., AIME, v. 74, 1926, pp. 810-817.

Contains observations of subsidence of a salt well in Kansas, as well as a description of subsidence over a sulfur deposit.

non-metal mining, surface subsidence damage

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This bulletin summarized current knowledge (1916) of mine subsidence in Illinois, Pennsylvania, and West Virginia.

vertical displacement, horizontal displacement, surface structural damage, subsurface structural damage, surface water, subsurface water, mine design, backfilling, law, literature search, coal mining, historical

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Examines subsidence at the time (1916) due to mining operations in Illinois.

coal mining, surface structural damage, subsurface structural damage, mine design, historical, backfilling, room-and-pillar, ground control, descriptive theories

Young, L. E. Influence of Rate of Advance and of Time Factor in Support of Active Workings in Bituminous Coal Mines. Trans., AIME, v. 130, 1938, pp. 270-283; also AIME Technical Paper No. 933.

coal mining, roof support, time factor, active mines

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roof bolting, ground control

Zachar, F. Some Effects of Sewickley Seam Mining on Later Pittsburgh Seam Mining. Mining Engineering, v. 4, No. 7, 1952, pp. 687-692.

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multiple-seam extraction, overburden

Zachar, F. Factors Influencing the Selection of Mining Systems. Mining Congress Journal, v. 55, No. 10, Oct., 1969, pp. 32-44.

Evaluates the factors which affected the mine layout, mining equipment, and economics of the mining systems used in the United States at the time (1969).

mine design

Zachar, F. Shortwall: A Way to Boost Production. Coal Mining and Processing, v. 9, No. 12, Dec., 1972, p. 39.

Presents a description of the shortwall concept and proposed methods of utilizing it to increase production.

law, mine safety, shortwall, roof support, coal mining

Zenc, M. Comparison of Bals' and Knothe's Methods of Calculating Surface Movements Due to Underground Mining. Int. J. Rock Mech. Min. Sci., v. 6, 1969, pp. 159-190.

Discusses the theoretical analysis of Bals' and Knothe's methods of subsidence prediction.

vertical displacement, horizontal displacement, prediction theories, prediction

Zeng, R. H., S. S. Peng. Prediction of Subsidence Basin by the Weibull Distribution Function. Proc., 2nd Workshop on Surface Subsidence due to Underground Mining, Morgantown, WV, June 9-11, 1986, S. S. Peng, ed. WVU Dept. of Mining Engineering, Morgantown WV, Aug., 1986.

Many subsidence researchers in the U.S. have developed new empirical function methods to predict subsidence, or attempted to validate some empirical functions developed by foreign

researchers for use in the U.S. An attempt is made in this paper to develop a new empirical function to predict a surface subsidence basin due to longwall mining.
prediction theories, computer, longwall, coal mining

Zhong, W. L., W. M. Ma, S. S. Peng. Prediction of Surface Subsidence by Probability Function Integration Method. Proc., 2nd Workshop on Surface Subsidence due to Underground Mining, Morgantown, WV, June 9-11, 1986, S.S. Peng, ed. WVU Dept. of Mining Engineering, Morgantown WV, Aug., 1986.

The probability function integration method is one of the influence function methods. It is a widely accepted method in many mining districts in China and Poland mainly because its theory and formulae can well represent the surface subsidence basins due to longwall mining of flat or near-flat seams.

prediction theories, influence function, surface structural damage

Zorychta, H., D. W. MacFadden, F. Smith. Strata Control Measurements in the Sydney Coalfield. Trans., Canadian Inst. of Mining and Metallurgy, v. 70, 1967, pp. 38-48.
ground control, instrumentation

Zwartendyk, J. Economic Aspects of Surface Subsidence Resulting From Underground Mineral Exploitation. Ph.D. Thesis, The Pennsylvania State University, State College, PA, 1971, 411 pp.
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Zwartendyk, J. Economic Aspects of Surface Subsidence Resulting From Underground Mineral Exploitation. U.S. Bureau of Mines OFR 7-72, 1971, 412 pp. NTIS PB 207 512.

This report consists of an extensive historical survey and bibliography of theories, remedies, and laws concerning surface subsidence.

economics, surface subsidence damage, historical, backfilling, law, literature search

KEY SUBJECTS

abandoned mines	monitoring design
active mines	monitoring equipment
agriculture	monitoring installation
angle of draw	monitoring methods
anthracite	multiple-seam extraction
architecture	National Coal Board
backfilling	non-metal mining
boundary element method	oil extraction
bumps	overburden
coal mining	partial extraction
computer	photography
construction	pillar extraction
continuum mechanics theories	pillar strength
descriptive theories	pipelines
economics	prediction
elastic theory	prediction theories
engineering	profile function
environment	railways
finite element method	reclamation
floor stability	remote sensing
fluid extraction	roads
foundations	rock mechanics
geologic features	roof bolting
geophysical methods	roof stability
geotechnical	roof support
government	room-and-pillar
ground control	seismic
high-extraction retreat	shortwall
historical	soil mechanics
horizontal displacement	soils
hydrology	stochastic model
in situ testing	subsidence research
influence function	subsurface structural damage
instrumentation	subsurface subsidence damage
insurance	subsurface water
lab testing	surface structural damage
land-use planning	surface subsidence control
land values	surface subsidence damage
law	surface water
literature search	survey data processing
longwall	survey design
mathematical modeling	survey equipment
metal mining	survey methods
mine design	time factor
mine fires	tunnelling
mine operation	utilities
mine safety	vertical displacement
mine waste	yielding supports
mitigation	zone area method
modeling	

abandoned mines

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